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THE COMMANDER-IN-CHIEF THEATER MISSILE DEFENSE ASSESSMENT PROGRAM IS A PROGRAM OF THE BALLISTIC MISSILE DEFENSE ORGANIZATION THAT ASSISTS THE WARFIGHTING COMMANDERS-IN-CHIEF IN ASSESSING THEIR TMD CAPABILITIES. IT PROVIDES NECESSARY FUNDING FOR EXERCISES THAT EXPLORE NEW TMD SYSTEMS AND OPERATIONAL CONCEPTS/PROCEDURES. THIS DOCUMENT DESCRIBES THE OBJECTIVES AND ACCOMPLISHMENTS OF THE PROGRAM SINCE ITS INCEPTION IN 1989 THROUGH 1994.

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COMMANDER-IN-CHIEF THEATER MISSILE DEFENSE ASSESSMENT PROGRAM

PROGRAM HISTORY AND EXERCISE FINDINGS 1989 - 1994

DEPARTMENT OF DEFENSE
BALLISTIC MISSILE DEFENSE ORGANIZATION
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

August 1995

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CHAPTER 1
TMD EXPERIMENTS, 1989-1994

OVERVIEW

The CINC TMD Assessment Program has grown significantly since its inception in 1989. This chapter describes each assessment conducted to date, including its objectives, conduct, and accomplishments. Chapters 3 through 6 discuss insights gained from the assessments in the areas of command, control, communications, and intelligence (C3I); attack operations; passive defense; and active defense.

EARLY TMD ASSESSMENTS

SPECIAL PROJECT QUIET SUNSET (1989)

The first TMD assessment was Special Project QUIET SUNSET. The overall purpose of the exercise was to examine the contribution of National, Theater and organic sensors, processors, and communication systems to countering the TBM threat. The assessment was to be used to develop long-range plans for future assessments and identify specific ways to improve or enhance the theater TMD architecture. This was a joint Army and Air Force effort with U.S. European Command (EUCOM) the sponsoring command, the Army Tactical Exploitation of National Capabilities (TENCAP) office the Executive Agent, and the Air Force TENCAP office acting as both the USAF Test Director and Test Office. Exercise objectives were developed based upon both Department of Defense and EUCOM TMD concerns.

Objectives

- Document current U.S. capabilities to detect, track, and engage TBMs in order to establish a baseline for future efforts.*
- Assess the impact of focusing National, Theater and organic intelligence collection assets on TBMs on other wartime collection tasks.
- Evaluate alternative methods of using National, Theater, and organic sensors, processors, and communication systems to detect, warn, and track TBMs and provide friendly forces with cueing and targeting data.
- Evaluate processing and dissemination system enhancements to improve timely information exchange to assist tracking, targeting and attacking TBMs.

Phase I of the exercise consisted of various research and analysis projects conducted under the auspices of the JTMD Management Office. A large-scale Warsaw Pact scenario served as the basis for a series of data runs by collection system simulators, including Tactical Level Collection System Simulation (TACSIM) and Exercise Capabilities (EXCAP). These efforts

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* This objective was delayed until future exercises.

resulted in proposed doctrinal, organizational and material measures to improve TMD operations.

Phase II consisted of simulation to determine the impact of focusing National, Theater, and organic collection systems on TMD targets. Collection systems followed a baseline strategy as well as four TBM-focused strategies in order to evaluate the responsiveness of the systems to TBM tasking as well as the impact of such tasking on other collection tasks. This phase was executed from December 1988 to June 1989 using the TACSIM at Ft Hood, TX to simulate Theater and organic electronic and imaging intelligence (ELINT and IMINT) data and the EXCAP simulator to simulate National ELINT and IMINT data.

Phase III consisted of a field exercise directed toward developing tactical support systems for locating and targeting TBMs. During the actual exercise, a Defense Support Program (DSP) simulator in Denver, CO simulated DSP detection of 70-100 TBM launches daily. This DSP data was transmitted via Tactical Receive and Related Applications (TRAP) and Defense Satellite Communications System (DSCS) communication paths to theater intelligence centers and tactical commanders. Designated experiment nodes collected data and assessed the timeliness of information receipt and distribution throughout the theater. Additional tests were run on the effectiveness of cross-cueing techniques (e.g. using various intelligence sources to cue National systems). Another activity involved assessment of the data processing and dissemination capabilities of new prototype systems to determine their potential for improving TMD information exchange.

Accomplishments

- Initial application of what was to become the USSPACECOM Tactical Event Reporting Systems (TERS), wherein predicted TBM launch and impact locations were disseminated to recipients via Satellite Communication (SATCOM) broadcast. This capability was subsequently used during Operations DESERT SHIELD and DESERT STORM.
- Provided orientation on the use of Land Satellite (LANDSAT) and Satellite Probatoire de L'Observation de la Terre (SPOT) and gathered ideas for follow-on employment of multispectral imagery (MSI).
- Demonstrated the advantages of stereo processing of DSP data.
- Initial use of TRAP broadcast as an alternative means for disseminating near-real time ELINT and radar imagery
- Initial application of Defense Advanced Research Project Agency (DARPA) developed Tactical use of National Means (TACNAT) system to the TBM problem. TACNAT is a "smart" garrison status monitoring system coupled with a terrain delimitation system.
- Introduced the Air Defense Systems Integrator (ADSI) prototype system. ADSI is used to transpose intelligence data into compatible formats to provide the entire air defense C2 system a common air picture.

- Introduced the Constant Source Operators Terminal (CSOT) prototype system to enhance the flow of battlefield intelligence to all echelons of command.
- Introduced Portable All-Source Analysis Work Station (PAWS) as a tool to expedite target nominations for Follow-on Forces Attack (FOFA).
- Successfully exercised cross-cueing procedures and in the process, validated two architectures -- Improved Commander's Tactical Terminal (ICTT) and Scaleable Transportable Intelligence Communications Systems (STICS).
- Determined, through large scale simulation, that specific prioritization of collection of TBM targets by National IMINT collectors neither significantly improved collection against those targets nor hindered collection against other problem sets.
- Validated current TBM target deck and collection strategy in TACSIM and EXCAP simulations.
- Highlighted the fact that these TMD experiments were fundamental to the JTMD program and offered an important first step for development of TTP in Theaters for TBM warning and targeting, and also to FOFA targeting.

SPECIAL PROJECT TORPID SHADOW (1990)

The second JTMD assessment conducted under the auspices of the JTMD Master Plan was titled Special Project TORPID SHADOW and was conducted in Germany between August 27 and September 7 1990. The objectives of the assessment were developed from insights gained during QUIET SUNSET. Again both the Army and the Air Force participated, with the former having the lead. The assessment was designed to evaluate C3I enhancements (primarily at HQ V Corps in Germany and HQ USAFE) to improve TBM indications and warning, cueing, and targeting. The exercise concentrated on the implementation of techniques and procedures to expedite the flow of critical intelligence data to tactical decision making nodes.

Objectives

- Assess enhancements to the Theater's intelligence dissemination and exploitation architecture in support of passive and active defense measures.
- Assess battlefield intelligence dissemination and exploitation methods to enhance the theater's capability to successfully target enemy TBM systems.

Planning for the exercise began immediately after QUIET SUNSET. Unfortunately, before the exercise could actually be conducted, Iraq invaded Kuwait and the bulk of everybody's attention turned toward the Gulf area. Much of the equipment that had been scheduled for assessment in the exercise was relocated to Southwest Asia before the assessment could occur. Additionally, DSP sensor test inputs planned to support the assessment were called off on August 13 in order to avoid any possible interference with critical real-world data. While these events affected the conduct of the

assessment, the majority of the assessment objectives were nonetheless partially or completely accomplished.

Accomplishments

- Targetable imagery reports from the TR-1 were successfully passed via TRAP to V Corps and the Echelons above Corps Intelligence Center (EACIC) targeting cells. USEUCOM requested this capability become permanent so the equipment was left in place.
- The ability to pass and display stereo DSP data via TRAP to Army and Air Force air defense units was validated and the value of this data over that previously available was demonstrated. This resulted in an Army ADA unit submitting a Mission Needs Statement for DSP stereo data.
- The utility of new software for both IPAWS and TACNAT was documented.
- The potential value of the ADSI to ADA units was validated as was the significant contributions of CONSTANT SOURCE to Tactical Fighter Wing (TFW) operations.
- The dissemination of U2 radar imagery reporting via TRAP from the U2 Ground Station was automated. This system was subsequently used to pass the initial results of Advanced Synthetic Aperture Radar System (ASARS) imaging to users during DESERT STORM.
- Final TBM rules and Intelligence Preparation of the Battlefield (IPB) software validated and artillery rule sets utilized and refined.

Operations DESERT SHIELD/DESERT STORM (August 1990 to February 1991) vividly demonstrated the threat posed to U.S. forces, friends, and allies by TBMs. Probably the most important validation of the success of QUIET SUNSET and TORPID SHADOW came when USCINCCENT (GEN Schwartzkopf) requested his command be immediately provided PAWS, CSOT, TACNAT, TR-1, and TRAP (all of which were originally planned for USCENTCOM testing in a FY91 assessment).

Capabilities proven during QUIET SUNSET and TORPID SHADOW were used effectively during the Gulf War. An early warning voice net was established; direct warning was provided to both Patriot and Air Force units via TRAP and voice networks; ADSI allowed the direct flow of warning data to Patriot units; a cross-cueing architecture was used; and IPB for TMD operations received significantly more emphasis than ever before. The Gulf War provided a tremendous opportunity to test these developing technologies further. Though hardly perfect, our TMD capability at the end of the Gulf War was much more advanced than our capabilities only two years earlier when the JTMD Experiments Program began.

SPECIAL PROJECT TORPID SHADOW II (1991)

The planning time for the FY91 assessment, Special Project TORPID SHADOW II, was relatively short due to the Gulf War. The coup in the

Soviet Union affected the conduct of this exercise as well. The assessment focused on enhancements to intelligence and reconnaissance procedures and systems in support of the TMD and Joint Precision Interdiction (JPI) missions. TORPID SHADOW II built on the findings and recommendations of the previous assessments, as well as lessons learned from Operations DESERT SHIELD and DESERT STORM.

Objectives

- Enhance Air Force and Army air defense capabilities in a TBM threat environment.
- Enhance Improved Prototype All-Source Analysis System (ASAS) Workstation (IPAWS).
- Enhance National IMINT support to TMD/JPI.
- Enhance National SIGINT support to TMD/JPI.
- Provide timely DSP support to TMD.

The intent was again to have an assessment combining simulation and real-world target collection data. The real-world part was to occur from September 23 to September 27 1991 and the simulation phase was to occur between September 30 and October 3 1991. Both the two previous exercises and to an extent DESERT SHIELD and DESERT STORM revealed deficiencies in the capability of the C4I architecture to support the conduct of TMD operations. The lack of interoperability of current and planned telecommunications and processing systems, for example, significantly delayed the dissemination of critical information. 32nd AADCOM units were to test their ability to integrate and interface Tactical Information Broadcast System (TIBS), CONSTANT SOURCE and TADIL-B data onto the ADSI, but due to a short-notice deployment order to Southwest Asia, were unable to perform more than a "shake-out" of the systems and conduct cursory training of the operators.

Accomplishments

- Proved the value of IPAWS modifications.
- SIGINT modifications proved invaluable. SIGINT activities involved unique application of the capabilities of selected parts of the National SIGINT system to cue other sensors for collection against TBM targets, to develop targets directly, and to further develop data bases.
- Demonstrated capabilities of National IMINT collectors. This included demonstration of systems to allow an operator to interactively move over, around and through the battlefield using LANDSAT and SPOT imagery. This prompted user requests for development of formal Statements of Need and Statements of Requirements.
- Improved automation of target development capabilities of V Corps G2 Targets and their interface to G3 Targets.
- Incorporated use of TIBS for data dissemination for the first time.

- Conducted initial "shake-out" of enhanced ADSI capabilities and proved ADA Bn with ADSI is capable of semi-autonomous operations.

SPECIAL PROJECT QUESTOR GRAIL (1992)

Special Project QUESTOR GRAIL, conducted from May 3 to 15 1992, initiated a new era in the JTMD Experiment Program in Europe. Prior to the exercise, USAREUR and USAFE were the major participants in the program, with significant contributions from DIA, NSA and USSPACECOM. Moreover, the focus of the program was the Soviet/Warsaw Pact TBM threat to the European Theater. This exercise marked a shift in EUCOM's focus from a general European war scenario to one addressing the command's role in a contingency environment. Moreover, QUESTOR GRAIL involved Sixth Fleet elements for the first time. This was the most comprehensive and first fully joint TMD effort since the inception of the program.

Objectives

- Passive Defense: Observe and report on current capabilities of selected USEUCOM units to receive and the provide timely passive missile defense warning information.
- Active Defense: Observe and report on current capabilities of selected USEUCOM units to receive and process tactical missile threat target data from sources external to organic air defense sources.
- Attack operations: Observe and report on current capabilities of selected USEUCOM units to execute attack operations to negate tactical missile threats.
- C4I: Observe and report on various alternatives for improving collection, processing, and dissemination of intelligence in support of TBM targeting.

QUESTOR GRAIL shifted focus from Central Europe to NATO's Southern Region with live intelligence collection directed to two of the principal potential adversaries in the Middle East. The nature of the National collection means and methodologies used eliminated any possibility for Allied participation in the assessment. While the assessment was overlaid on SACEUR Exercise DRAGON HAMMER, it was a separate effort and did not influence the exercise's scripted scenario. A Joint Task Force (JTF) was established for the exercise to provide an operational focus and to work out real-world priorities and/or problems in support of QUESTOR GRAIL.

Accomplishments

- Initial voice warning broadcast by HQ USEUCOM to selected components.
- Capability to share a common air picture among Army, Navy, and Air Force air defense elements was demonstrated.
- DSP data broadcast to AEGIS.
- ADA battalion situational awareness was enhanced by receipt of TRAP broadcasts.

- Selected USEUCOM units were able to use intelligence inputs to target TBM launch points, though the system lacked responsiveness.
- The DSPO Advanced Data Link Program, the Navy P-3 ISARS, and the USAREUR Deployable Intelligence Support Element (DISE) were used for the first time in support of TMD experimentation.
- U2 off-tether imaging data was received by theater users in minutes versus hours.

EXPANSION OF JTMD EXPERIMENTS PROGRAM

The CINC TMD Assessment program expanded in 1993 to three CINCs. Exercise names were determined for USEUCOM (Joint Project OPTIC NEEDLE (JPON)); U.S. Forces, Korea (USFK) (Joint Project ORNATE IMPACT (JPOI)); and U.S. Central Command (USCENTCOM) (Joint Project OPTIC COBRA (JPOC)).

JOINT PROJECT OPTIC NEEDLE (1993)

This was to have been the last of the five planned TMD assessments in USEUCOM, and would have placed greater emphasis on attack operations than previous exercises. The exercise was assigned to AFSOUTH and LANDSOUTH operators supported by a USEUCOM TMD Cell, all located in a NATO warfighting headquarters complex in northern Italy. Mock strike missions were planned against surrogate TBM Transporter-Erector-Launchers (TELs). The surrogate TELs were scheduled to move in doctrinal fashion in concert with simulated DSP data processed by the Tactical Surveillance Demonstration system installed for the assessment at Kelly Barracks in Stuttgart. This simulation was to have triggered live collection against the surrogate TELs in designated operational areas on Sicily. An early warning system was planned to include NATO participants, and U.S. PATRIOT units using the new Battalion Tactical Operations Center (BTOC) were scheduled to conduct mock engagements against cruise missile launchers.

In April 1993, one month prior to the scheduled start of the experiment, AFSOUTH's Mediterranean Exercise DRAGON HAMMER was canceled due to AFSOUTH's enforcement of the United Nations No Fly Zone over Bosnia. USEUCOM decided it would be impossible to execute OPTIC NEEDLE. Other avenues to accomplish the exercise objectives were evaluated, and it was decided to conduct a TADIL A/B connectivity exercise demonstrating the ability to provide an AEGIS air picture to a Patriot unit.

Accomplishments

- Army unit reported 100% reception of all test tracks provided by USN.
- Validated TADIL-B High Frequency data link connectivity from USN ship through Air Force Air Control Squadron (ACS) to Patriot unit.

JOINT PROJECT OPTIC COBRA (1993)

USCINCCENT was briefed on the JTMD Experiments Program in mid-1992. Later meetings resulted in a desire to incorporate the first

USCENTCOM TMD experiment into their major FY93 command post exercise, INTERNAL LOOK 93. It was later decided that a full-blown assessment such as those executed by USEUCOM was not feasible in FY93. As a result, the focus of the CENTCOM effort was changed to: (1) development of the USCENTCOM JTMD Experiment Program Procedures; (2) documentation of the command's tactics, techniques, and procedures (TTP) for JTMD ; (3) initiation of the integration of JTMD into simulation support capabilities; and, (4) initiation of planning for FY94 assessment projects.

Accomplishments

- USCENTCOM developed draft TTP to be validated in later assessments.
- Experiment Program Procedures were published and provided to other combatant commands, HQDA, and BMDO for consideration as a standard procedure for the overall assessment program.

JOINT PROJECT ORNATE IMPACT (1993)

In late FY91, SDIO agreed to support assessments in the Pacific in late FY93. Funds were provided for intelligence preparation of the theater and architecture development in FY92 and conduct of an assessment in FY93. TMD planning began immediately, and in less than one year, USFK successfully demonstrated an operational TMD architecture with supporting C4I connectivity.

The first USFK TMD exercise was conducted between August 17 and 28 1993. The exercise emphasized interoperability between the theater and component levels, flexible communications and dissemination of theater and tactical sensor products. Enhanced collection, exploitation, and dissemination of TBM data helped refine attack operations procedures. Experiment objectives paralleled those from recent European TMD experiments.

Objectives

- Passive Defense: Assess the Passive Defense capabilities of the current theater C4I architecture, interfaces, and connectivity to provide timely warning of impending TBM attack to the appropriate levels of the chain of command. This assessment focused on the timeliness and reliability of the delivery of voice warnings to tactical commanders.
- Active Defense: Assess the Active Defense capabilities of the current theater C4I architecture, interfaces, and connectivity to provide timely launch warning to critical nodes of the Korean peninsula's Air Defense Net (this means both the Patriot missile batteries and their BTOC).
- Attack Operations: Assess the Attack Operations capabilities of the current theater C4I architecture, interfaces, and connectivity to support CFC component commander attack operations targeting of both attack aircraft or the Army Tactical Missile System (ATACMS). The focus of this objective is on both the timeliness of dissemination of launch location

data and the refining of targeting data base information, particularly in reducing the size of TEL location's circular error probability.

- Sensor Support: Assess the C4I capabilities of national and theater sensor systems to satisfy the requirements for TMD data within the timeliness and accuracy constraints set by theater, component, and tactical commanders.

ORNATE IMPACT took place in three phases:

Phase I demonstrated current USSPACECOM capabilities to support theater and tactical commanders.

Phase II demonstrated the near-term enhanced capabilities of USSPACECOM to process launch event data in stereo in support of theater and tactical commanders via enhanced operational communications connectivity.

Phase III demonstrated the potential enhancements to capabilities achievable with the deployment of the Joint Tactical Ground Station (JTAGS) in theater. Phase III also included assessing dissemination of alert reporting on various nets.

Accomplishments

- Validated voice warning architecture for Korea
- Demonstrated ability of C4I architectures to transmit data early warning to the air defenders in Korea in sufficient time for them to take appropriate actions.
- Established a TMD Attack Operations SOP and supporting C4I architecture that provided timely data dissemination for use in attack operations.
- Heightened awareness within theater of TBM threat. Decisionmakers consequently accorded Patriot a higher priority in theater warplans and Time Phased Force Deployment List (TPFDL).
- Gave all involved an opportunity to exercise equipment and TTPs.
- Institutionalized integration of realistic TMD play into annual USFK CPX.
- Left systems in theater to support current USFK TMD capabilities.

KEEN EDGE II (1994)

This assessment examined procedures for the receipt of voice and data warning to U.S. Forces, Japan (USFJ) during a command post exercise. U.S. government disclosure policy prevented USFJ from releasing specific mission data, other than missile launch times, to Japan Self-Defense Force (JSDF) elements participating in the exercise. All data messages, and the specific mission information, were held in US-only channels throughout the assessment.

Objectives

- Assess the capability of existing communications architectures to provide timely voice warning of TMD missile launch to USFJ command nodes.
- Assess the capability of existing data architecture to provide timely delivery of missile launch data messages to USFJ Command Center and USFJ JFACC (5 AF).

Accomplishments

- Voice warning of missile launch was passed via the two current early warning architectures for USPACOM forces:
  - In-the-clear voice warning over unclassified Defense Switch Network (DSN) phone lines from the USSPACECOM Missile Warning Center in CONUS to USFJ and 5 AF Command Centers. USFJ then initiated a conference call to the Service Components and echoed the message received from USSPACECOM. This architecture provided voice warning to all organizations incorporated into the current command DSN early warning network.
  - Voice messages passed over the secure Defense Red Switch Network (DRSN) to the USPACOM command center, which electronically relayed the CONUS voice broadcast over the USPACOM CINC-1 UHF SATCOM network. This architecture provided voice EW to elements which were not necessarily connected to the DSN net -- for example, Seventh Fleet ships at sea.
- Missile launch data messages were transmitted, via the TRAP broadcast system, to the USPACOM theater. USFJ and the 5 AF Command Centers were prepared to receive and process these messages. The messages were received, processed and displayed by the Constant Source (CS) system in the 5 AF Command Center. The TMD messages of interest were also intercepted and displayed by the Standard TRE Display (STRED) unit in the USFJ Command Center.

JOINT PROJECT OPTIC COBRA (1994)

JPOC 94 was conducted in conjunction with the USACOM-sponsored and FORSCOM-executed exercise ROVING SANDS 94 between April 18 and May 10 1994. The project added a TMD environment to the ROVING SANDS scenario. The intent was to build on the TMD architectures employed by CENTCOM during DESERT STORM and observe and document existing JTMD C4I procedures and architectures in an realistic training environment to determine what actions USCENTCOM must implement to facilitate JTMD.

JPOC 94 assessed TMD tactics, techniques, and procedures and C4I architectures for a Joint Task Force deploying to a developing theater. Each phase focused on a subset of the JTF C2 and Integrated Air Defense System (IADS) structure to replicate the anticipated C2 build up in the succeeding force deployment phases of the JTF.

Objectives

- Passive Defense: Assess and document the current C2 procedures and structures for providing timely passive TMD warning of tactical missile attack to appropriate elements of a deploying JTF.
- Active Defense: Assess and document the current C2 procedures and structures for conducting active TMD operations by IADS elements of a deploying JTF.
- Communications Architectures: Assess and document the capability of existing communications architectures and reporting to support effective TMD (passive and active) operations within the IADS of a deployed JTF.
- C4I Systems: Assess and document the capability of available C4I systems to support TMD operations by IADS elements of a deploying JTF.

Accomplishments

- Passive Defense
  - Demonstrated need for JTFs to develop a procedure for receipt and dissemination of TMD voice warning consistent with available/capable organizations and equipment.
  - Proved feasibility of having JTAGS operators, Corps ADA Brigades, and Air Operations Center provide TMD voice warning to the JTF.
  - Demonstrated need for a CRC capable of providing TMD voice warning to the JTF.
- Active Defense
  - Demonstrated need for ADA Bns to develop and implement procedures for Bn C2 of active TMD operations.
  - Demonstrated capability of JTAGS operators to provide both voice and data launch warning to the IADS.
  - Demonstrated ability of EAC ADA Brigade, augmented with the ADTOC, to provide effective C2 over active TMD operations
  - Demonstrated that the AOC, augmented with a Battlefield Coordination Element (BCE), has the means to provide some level of C2 for active TMD operations.
  - Demonstrated that it is possible to continue C2 of active TMD operations in a designated IADS environment; however, procedures must be established in advance.
  - Demonstrated the need for further work to explore the cruise missile threat and determine specific requirements for special C2 procedures.
- Communication Architectures
  - Demonstrated that voice warning is an acceptable means of alerting at-risk forces; however, improvements are needed to address multiple event reporting, as well as size of area at risk.
  - Demonstrated the great utility of TDDS (formerly TRAP) and TIBS for dissemination of essential TMD information; however, no single system alone guaranteed delivery of the information.

  - Demonstrated that a direct receive capability of UHF SATCOM information significantly improves the time of receipt of warning information.
- C4I Systems
  - Demonstrated need for standardization of launch detection reporting symbols between display terminal and value of integrating an audible alarm/alert indication for incoming TBM reports.
  - Demonstrated worth of TDDS information being available at the receiver for successive C2 levels of the IADS.
  - Demonstrated that UHF SATCOM voice EW is more valuable for initiation of passive defense measures for at-risk, non-IADS units than it is to IADS units, since IADS data reports serve the dual purpose of supporting both active and passive defense requirements.
  - Demonstrated that ADSI provided a timely composite air situation picture which has high utility for the conduct of active missile defense operations as needed by the ADA Bde Hqs.
  - Demonstrated that in the form of data and voice support, the JTAGS can provide timely essential TBM launch information for use in both active and passive defense of deployed joint forces.

JTF-95 (1994-1995)

USACOM, as an integrator of joint capabilities and "force provider" for USEUCOM and other theaters, decided in FY94 to take the lead in the tactical development of a Joint Task Force focusing on TMD. The goal is to network operational capabilities into a trained national JTMD capability that can be requested by supported CINCs as part of a deploying force package. USACOM, in coordination with supported CINCs, would concentrate JTMD efforts on jointly training current TMD capabilities and on providing a clearinghouse for information exchanges between JTF TMD systems, to test various cueing communication channels, to provide improved situational awareness to commanders and Patriot shooters, and to coordinate R&D clip-ons to scheduled Joint exercises. The first exercise was conducted in two phases and involved Army, Navy, Air Force, and Marine forces as well as the National Test Facility (NTF):

Phase I was a two-day active/passive defense exercise involving simulated targets conducted between June 30 and July 1 1994 in the Virginia Capes area. It was scheduled as a TMD "train-up" of JTF 95-1 (the USS *Eisenhower* battle group) as it prepared to deploy to the USEUCOM AOR in the first quarter FY95 with several ships equipped with the Navy's Cooperative Engagement Capability (CEC).

Phase II was a two-day, live flight exercise conducted August 18-19 1994. The test involved having an AEGIS SPY-1 radar detect the launch, pass data to CEC for further dissemination to other units involved in the JTMD effort.

The Army's Airborne Surveillance Testbed (AST) aircraft also participated in the exercise.

Objectives

- Establish an effective integrated air defense.
- Exercise TBM Defense alert and cueing networks.
- Improve situational awareness.
- Demonstrate joint value added of prototype CEC.
- Jointly track simulated threats and conclude with a live ballistic missile launch.
- Provide opportunities to demonstrate emergent technologies.

Accomplishments (Simulation Phase)

- Successfully integrated existing C2 centers in support of TBM operations.
  - Patriot Information Coordination Central
  - USAF Control and Reporting Center (CRC)
  - USN Combat Direction Center
  - US Marine Tactical Air Operations Center (TAOC)
- Successfully integrated tactical communication networks in support of TBM operations.
  - Tactical Information Broadcast Service (TIBS)
  - Tactical Data Dissemination System (TDDS)/Tactical Receive Equipment (TRE)
  - UHFSATCOM
  - TADIL-A
- Successfully integrated existing TMD related weapon, early warning, and sensor systems.
  - E-3A AWACS, Patriot, TALON SHIELD/ALERT
  - Aegis, TPS-75, JTAGS
  - TPS-59, AN/SPS-48E, Defense Support Program
- Successfully integrated TMD related, near-term deployable R&D "clip-ons".
  - Airborne Surveillance Testbed (AST)
  - USN CEC
  - USN Joint Maritime Command Information System (JMCIS)
  - Theater Planning Tool (TPT)

Accomplishments (Live Flight Phase)

- USN CEC received launch notification from Aegis in 20 seconds.
- Patriot received notification and tracking data within 40 seconds from CEC.
- CEC provided all stations with launch location, radar plots, track notification, and prediction/location of missile impact simultaneously in near real time.
- For C2, CEC provided ground truth as to where units are located
- AST aircraft acquired live missile target before burnout.

- Demonstrated JTMD capabilities to representatives from six NATO countries.

JOINT PROJECT OPTIC NEEDLE II

OPTIC NEEDLE II was to have built on the foundation of previous assessments and focused on improving the timelines for conducting TMD operations. It was to have exercised the entire USEUCOM JTMD architecture during the three phases of a conflict: Preparation for War, Transition to War, and Conduct of War. The exercise was have concentrated, for the first time, on those activities necessary to execute strike operations against simulated theater missile TELs and their associated support facilities using Army, Navy, and Air Force strike assets. Original planning had this exercise overlaid on Exercise DYNAMIC IMPACT in May 1994. It was to have been a joint operation that would have exercised the complete sensor-to-shooter architecture, involve live intelligence collection, special operations forces, Unmanned Aerial Vehicles (UAV), and several other capabilities not available for use in FY93. Due to real world missions in Bosnia, DYNAMIC IMPACT was canceled and the TMD exercise was rescheduled to be overlaid on AFSOUTH's Exercise DYNAMIC GUARD (October 1994). The decision was also made to exercise the deployment and integration of a EUCOM TMD Cell during a Joint Force Air Component Commander (JFACC) exercise (TRAILBLAZER II) in July 1994. A second test of the TMD Cell would occur during Exercise ATLANTIC RESOLVE in late October/early November.

TRAILBLAZER II (1994)

EUCOM executed TRAILBLAZER II between July 5 and 15 1994 at the Warrior Preparation Center in Germany. The primary purpose of the exercise was, for the first time, to deploy TMD Cell cadre in support of the 32nd Air Operations Group (AOG) and integrate TMD Cell procedures into the AOG Combat Operations Cell. The TMD Cell is an *ad hoc* organization of personnel with training on specific intelligence and operations systems formed around a core of European Command J36 TMD personnel. The cell deploys at the request of the supported Joint Force Commander (JFC) to provide TMD capabilities in the threatened area. This cell will locate wherever the JFC requires with considerations to defensive or offensive capabilities.

Accomplishments

- Reinforced the need to develop, document, and train with an SOP for employment of a TMD Cell in support of a JFACC.
- Validated value of the DIA Geographic Area Limitation Environment (GALE) system in TMD operations.
- Demonstrated need for TMD Cell to have closer ties to the intelligence collection and production elements support the JFC.

- Demonstrated need for TMD Cell to be equipped with one or more dedicated sets of equipment capable of rapid deployment in support of the JFC, one of which must be available for training of cell personnel.
- Showed that SOF forces have the capability to take direct action against TMD targets; however, they are better employed in a Human Intelligence (HUMINT) or target designation role.
- Procedures need to be refined to respond to "short-dwell" targets. There is a limited capability to "re-role" aircraft, so ATACMS becomes the weapon of choice because it is more responsive (but issues of positioning, ordnance availability, and clearance of air corridors need resolution).

JOINT PROJECT ORNATE IMPACT II (1994)

The second USFK assessment was overlaid on the CFC command post exercise ULCHI FOCUS LENS in August 1994. The goal of the exercise was to examine the tactical utility of new and improved JTMD procedures and systems supporting combat operations in a wartime environment (particularly the use of a JFACC TMD Cell as a TMD *ad hoc* targeting adjunct to the Execution Cell and BCE). The ultimate goal was to assess the efficiency and effectiveness of the Korean Theater of Operations (KTO) TMD standing operating procedures. The entire JTMD communications architecture was to be exercised. JPOI II concentrated, for the first time, on those procedures necessary to execute all aspects of TMD against simulated TBM TELs and their associated support facilities. Simulated data was inserted at the JTAGS prototype in theater and at ALERT and Tactical Detection and Reporting (TACDAR) models within the NTF Advanced Real-Time Gaming Universal Simulation (ARGUS) system in Colorado. This experiment aided greatly in establishing the JTMD baseline architectures for Korea and documented the need to develop and experiment with JTMD procedures. Participants came from both U.S. and Republic of Korea (ROK) forces.

Objectives

- Passive Defense: Assess theater procedures for receipt and dissemination of missile launch warning voice reporting to, and by, USFK/CFC.
- Active Defense: Assess theater procedures for receipt and dissemination of TBM flight profile data to a Patriot unit operationally deployed in the KTO. Focus is on the efficacy of the cueing data provided to this unit.
- Attack Operations: Assess theater procedures for receipt and dissemination of TBM launch point data to include distribution/tasking of targets and target data to airborne controller and strike aircraft, or to ATACMS Fire Direction Center (FDC)
- C4I: Assess theater intelligence preparation of the battlefield (IPB) capability to support TBM infrastructure identification and targeting in the Single Prioritized Integrated Target List (SPITL), pre-Integrated Tasking Order (ITO) and ITO development process.

Accomplishments

- Passive Defense
  - Demonstrated capacity to initiate passive defense measures and pass warning in sufficient time for affected units to take appropriate action.
- Active Defense
  - Voice warning system proved to be good complementary capability for TIBS transmission and often provided initial warning, but data warning still proved to be most useful.
  - Multiple source cueing data via multiple paths ensured information was received in the shortest time possible for each event.
- Attack Operations
  - Demonstrated need for further work on TTP for attack operations to reduce timelines and increase accuracy of targeting.
  - First in-theater assessment of the GALE network in support of Attack Operations.
  - First in-theater operational assessment of a deployed JTAGS and simulated feed of Aegis radar data.
- C4I
  - Demonstrated need for further work on TMD IPB procedures.
  - Demonstrated viable process of nominating and integrating TMD targets into SPITL and insertion into CACC ITO.
  - First in-theater assessment of the Mobile TRE in support of CINC wartime relocation requirements.
  - First in-theater assessment of the RADIANT MERCURY and GIST solution to the releasability issue.

DYNAMIC GUARD (1994)

USEUCOM conducted this TMD assessment during the Allied Forces Southern Europe (AFSOUTH) exercise DYNAMIC GUARD between October 1 and 11 1994. This assessment, held in Turkey, marked the first time TMD had been examined as part of a major exercise in NATO's southern region. The purpose was to integrate TMD into one particular NATO infrastructure by providing AFSOUTH a TMD cell capable of (1) initiating missile event voice and data warning and (2) providing three target sets to decision makers for attack operations purposes.

Objectives

- Passive Defense: operate a full warning net under AFSOUTH architecture
- Active Defense: integrate with US Naval elements, including the development of a common air picture
- Attack Operations: practice procedures only

The assessment included both Dutch and German Patriot battalions and COMSTRIKEFORCE SOUTH naval assets. The TMD Cell consisted of the following hardware suite: JTAGS remote terminal, GALE, Linked Operations-Intelligence Centers Europe (LOCE) terminal, and

communications links to connect the TMD Cell with various C2 centers. The TMD Cell was collocated with the 1st Turkish AOC (the decision, made by COMAIRSOUTH that separated the TMD Cell from the JFACC, made this test setup different from the previous TRAILBLAZER II) . An ADSI terminal was collocated with 6th Allied Tactical Air Force's (6th ATAF) Modular Control Element (MCE) to provide the TMD portion of the common air picture.

Missile events were generated at the JTAGS remote terminal using scripted events executed on command of the OPFOR. Voice warning was passed from the TMD Cell to subordinate units by three independent means:

(1) to senior AFSOUTH Hqs via AFSOUTH HICOM net (UHF SATCOM)

(2) to maritime Hqs via GREEN HICOM (UHF SATCOM)

(3) to the Turkish forces via HM 004 net (unsecure HF)

Active Defense warning data was transmitted from the JTAGS by secure (STU III) phone to the ADSI which passed the data to the MCE. MCE translated the data as required and passed it to both Patriot Bns, COMSTRIKEFORCE SOUTH (AEGIS), and the Turkish Sector Operations Center (SOC) to update the Recognizable Air Picture (RAP). JTAGS also passed launch data directly to GALE.

Attack operations began with GALE delimiting the terrain in the launch area and providing a target set consisting of a point target representing the best possible launch site, a route target focusing air attack assets on the most likely movement option, and a set of hide location targets. This target set was passed to the AO cell for action.

LOCE was linked through Naples with the Joint Analysis Center (JAC) in Molesworth, England. LOCE provided intelligence information pertinent to TMD operations in the AFSOUTH AO. Additionally, LOCE passed hard copy launch data to all subscribers.

Accomplishments

- The exercise gave AFSOUTH a much clearer understanding of how JTMD fits into their C2 architecture and are serious about developing a workable, flexible JTMD architecture
- AFSOUTH is now keenly aware of the complexity of JTMD operations, not the least of which are hardware communications requirements
- AFSOUTH realizes they have a good deal of work ahead as they refine, expand capability, and test toward their objective system.
- Demonstrated ability to pass voice warning to land, sea, air, and allied forces in their austere communications environment within one minute.
- Data warning had problems due to the communications architecture used, but did get to Dutch Patriot units in time for them to react accordingly.
- The TMD Cell developed reliable target sets for attack operations in a timely manner (less than 5 minutes in most cases) using GALE.

- Used available resources and therefore constrained by them (not the objective architecture that would come with JTMD Cell and be overlaid on AFSOUTH's C2 architecture).

ATLANTIC RESOLVE (1994)

ATLANTIC RESOLVE, executed in Germany between October 27 and November 7, 1994, was the second exercise during which the USEUCOM JTMD Cell operated as part of a JFACC organization (TRAILBLAZER II being the first). The JTMD Cell's purpose during this exercise was to initiate both voice and data warning and provide information on missile impact areas, launch points, TEL relocation routes, and potential TEL hide sites for attack operations. Participants included USEUCOM, USAFE, USAREUR, USNAVEUR/SIXTH FLEET. The TMD assessment was overlaid on the Synthetic Theater of War - Europe (STOW-E) simulation being used for REFORGER 94.

The JTMD Cell consisted of a JTAGS remote terminal, GALE terminal, TIBS/TRAP all-source receiver, ADSI computer terminal, UHF TACSAT communications, and a dedicated DSN telephone system. The TMD Cell was located in the JFACC complex. Missile events were generated at the JTAGS remote terminal using both pre-scripted and free-play events directed by the OPFOR. Voice warning was disseminated to selected subscribers over a dedicated DSN line. This was an alternate system put into effect because the normal JTMD Cell UHF TACSAT channel was required to support real-world operational requirements. Initial warning was passed to the members of the Combat Operations element by the JTMD Cell based on a launch appearing on the JTAGS. Initial information was quickly refined and then passed over a loud speaker system and overhead projection. Data was passed over a hardwire connection from the JTAGS to the GALE system. The ADSI received its missile data from a TADIL-A translator from the Warrior Preparation Center (WPC). Active defense information was passed via voice to the ADA cell that was located adjacent to the JTMD Cell.

Attack operations began with GALE delimiting the terrain in the launch area and providing refined launch points, relocation routes, and potential hide sites. These target sets were transcribed by the GALE operator onto target recommendation form and provided to a JTMD Cell representative who then provided them to both Army and Air Force action cells. The objective was to fire ATACMS or task an air asset to strike the target. If an attack asset was not feasible, then a reconnaissance asset was to be targeted. Throughout the exercise four ATACMs were fired at suspected TEL launch locations identified by both JTAGS and the GALE, none of which succeeded. A total of seven F-15E fighter packages were directed against suspected TEL launch locations as identified by both JTAGS and GALE, resulting in the destruction of 14 of the OPFOR's 18 launchers.

Seven computer models drove the exercise scenario, however, throughout the exercise TMD activities had to be manually adjudicated due to modeling limitations of the Air Warfare Simulator (AWSIM) and Corps Battle Simulation (CBS). The five other computer models were: TACSIM; National Wargaming System (NWARS); Synthetic Imagery Generation System (SIGS); Battlefield Intelligence Collection Model (BICM); and the Research, Evaluation & Systems Analysis (RESA) model.

Accomplishments

- Many visitors, from Chief of Staff, Army down, got to see what the JTMD Cell could do.
- JTMD Cell and JFACC Intelligence element interaction made positive advancements.
- Identified need to hardwire ELINT into GALE to reduce time for keying on SCUD launchers and their locations.
- Staff were exercised well because of the free play nature of the exercise and their being kept out of the loop on how events were expected to go.
- SOF forces recognized now as JTMD players by virtue of both providing and receiving TBM information.
- U-2Rs are now active JTMD players and provided search areas by JTMD Cell.
- Passive voice EW occurred within 60 seconds in virtually all instances.
- Shooters got necessary information to shoot (in AO) most of the time.
- First time Army and Navy exchanged platform tracks and graphics overlays.
- Established and demonstrated procedures to communicate between the Navy and Army using the Navy's OTCIXS communications capability (UHF SATCOM/OTH-GOLD).
- Demonstrated the ability to support AD design by creating a TMD consistent tactical picture.
- Established procedures to create and distribute Nuclear, Biological, and Chemical (NBC) warning messages, including a contamination footprint overlay.

AFRICAN EAGLE (1994)

AFRICAN EAGLE was proposed as a combined exercise involving US Army, Air Force, Navy and Marines, and the Moroccan Army, Air Force, Navy and Special Forces. The original plan had a JTF and JFACC afloat which would have provided an initial test of the afloat concept for the TMD Cell and JFACC. The TMD-in-a-Box would have gotten its initial check out during the Moroccan exercise in parallel with the TMD Cell afloat. The focus of the exercise was to demonstrate effective joint planning/execution of TMD operations, to share a combined battlefield picture, and to effect a coordinated transition of TMD responsibilities from afloat to shore. The shared picture was to come from the Navy's OTCIXS broadcast system. If successful, a detailed TTP could be developed. This Moroccan exercise never came to

fruition due to political concerns. HQ USEUCOM then decided to execute a modified version of the originally planned JTMD Experiment in Germany. This effort would center around those objectives which support evaluation of the USEUCOM TMD-In-A-Box capability at Kelly Barracks in Stuttgart in early December 1994.

Objectives

- Conduct JTMD pre-hostilities activities such as IPB, data base builds, TMD training, and prepare to provide early warning (EW) from the TMD-in-a-Box, of a TBM launch to selected deployed units.
- Develop and exercise those procedures needed for the TMD-In-A-Box to develop and hand-off the information needed for theater air defense nodes to rapidly target incoming hostile theater missiles. Provide a common air picture to selected theater air defense nodes.
- Develop and exercise those procedures needed for the TMD-In-A-Box to rapidly identify and hand-off, to land attack assets, mobile Theater Missile systems so as to ensure the effective conduct of land-oriented counterforce/attack operations.
- Conduct an independent investigation of the TMD-In-A-Box concept. The investigation will concern itself with determining if the system can duplicate all of the required functions of the TMD Cell.
- Observe and report on general capabilities of the TMD-In-A-Box that are not specifically identified in the previous sub-objectives.

Accomplishments

- TMD-in-a-Box demonstrated the ability to:
  - receive TADIL-A, TDDS, TIBS, CNN, weather, and GPS data.
  - transmit to and receive data from ships equipped with JMCIS.
  - fuse TADIL-A, TIBS, TDDS, and OTCIXS data onto one situational overlay displayed on a Warrior terminal.
  - fuse weather data with JTAGS-produced predicted impact points to develop NBC overlays and pass them to naval units.
  - overlay JTAGS-produced missile tracks on current situational maps and pass that data to naval units.
  - receive JTAGS missile tracks and automatically pass them to GALE.

CHAPTER 2
MODELING AND SIMULATION

OVERVIEW

The way a command rehearses TMD operations in peacetime will have a major impact upon the way it conducts them during wartime. Simulations have become integral to most military exercises, and TMD exercises are no different. It is frequently too expensive to consider live TMD launches to support TMD assessments. In many theaters, live TBM launches are politically unacceptable as well. TMD assessments are overlaid on either live-play field training exercises (FTXs), computer assisted exercises (CAXs), or command post exercises (CPXs). Simulations, defined in the JCS Training Master Plan as "all training activities short of combat operations", are routinely used throughout the program. For example, in FTXs we simulate missile launch warning messages and use surrogate targets to represent missile launchers and support equipment. In CPXs we use an end-to-end TMD simulation architecture or provide scripting support to manually executed exercises. The use of simulations saves time and money. Moreover, we can more easily control the actual flow of the experiment by carefully scripting a scenario. Each simulation has inherent advantages and disadvantages in portraying TMD events. This chapter lists those models, simulations, and facilities that have been employed in assessments to date and describes lessons learned from the use of modeling and simulation in the program.

MODELING AND SIMULATION FACILITIES AND TESTBEDS

The CINC TMD Assessment Program has used a range of simulation facilities to examine the TMD capabilities of U.S. European Command (USEUCOM), U.S. Central Command (USCENTCOM), and U.S. Pacific Command (USPACOM).

WARRIOR PREPARATION CENTER

Located at Ramstein AB, Germany, the Warrior Preparation Center (WPC) serves as U.S. European Command's simulation center. The WPC houses both the Corps Battle Simulation (CBS) and Air Warfare Simulation (AWSIM), described below.

KOREA BATTLE SIMULATION CENTER

The Korea Battle Simulation Center (KBSC), located at Yongsan, South Korea, serves as the simulation support facility for the Korea Theater of Operations. The KBSC houses both CBS and AWSIM.

NATIONAL TEST FACILITY

The National Test Facility (NTF) is located at Falcon AFB, Colorado. The NTF houses the ARGUS model, described at length below. In addition, the NTF's Wargame Simulator provides a capability for evaluating human in control for large-scale missile defense exercises. The NTF networks to other wargame facilities, such as the Theater Air Command and Control Simulation Facility (TACCSF) at Kirtland AFB, New Mexico, for the detailed models and human-in-control positions needed for individual exercises.

THEATER MISSILE DEFENSE SYSTEM EXERCISER

The Theater Missile Defense System Exerciser (TMDSE) is being developed to help resolve some of the major theater integration and interoperability issues. It will provide a real-time, dynamic, tactical hardware-in-the-loop, system-level test capability. The TMDSE allows for extrapolation from few-on-few system integration tests to full engagement scenarios in any feasible environment. The heart of the TMDSE is a test and control node and a theater environment node which will generate a common threat scenario. The coordinated threat is then presented to all the TMD elements hooked into the TMDSE in real time. Tactical operators for these elements will provide the dynamic interface. The TMDSE will provide the means to evaluate the operation of the TMD system under full loading and in the presence of countermeasures.

MODELS AND SIMULATIONS

To date, the portrayal of TMD events in theater exercises has relied upon current theater-level simulations. This section describes individual models used to support TMD assessments and examines their advantages and disadvantages.

ALSP CONFEDERATION

The ALSP Confederation consists of a family of low-fidelity models optimized for theater-level simulation. The confederation consists of the following models:

- Corps Battle Simulation (CBS) portrays ground combat;
- Air Warfare Simulation (AWSIM) portrays air warfare;
- Research, Evaluation & Systems Analysis (RESA) model, which portrays naval combat;
- Tactical Level Collection System Simulation (TACSIM) and National Wargaming System (NWARS), which portray intelligence collection; and
- JECEWSI, which portrays electronic warfare.

The ALSP Confederation of models has been used to portray TMD events in TMD assessments. Below are listed individual models and their use during TMD assessments.

Model	Events Portrayed
CBS	• TEL movement • Location of ground-based TMD systems • Damage against some ground targets (e.g., logistics depots)
AWSIM	• TBM flight • Air sorties • Damage against some airfields
RESA	• Location of sea-based TMD systems
TACSIM/NWARS	• Intelligence collection against TBM targets

The ALSP Confederation models have the advantage of being standard theater warfare models. By using them, TBM and TMD events can be integrated more easily into theater exercises. However, TMD assessments have revealed the following shortfalls in the confederation's ability to model TMD events:

- One important limitation is its low fidelity and slow (sixty-second) refresh rate of confederation models. For example, the inability of AWSIM to accurately portray active defense engagements became apparent during Joint Project ORNATE IMPACT II.
- The same exercise revealed that AWSIM includes incorrect assumptions about the raid size needed to saturate Patriot as well as the missile's self-defense capability.
- Exercises conducted in Europe have demonstrated that terrain features in CBS are sometimes inconsistent with Defense Mapping Agency (DMA) data incorporated into higher-fidelity planning aids such as the Generic Area Limitation Environment (GALE). CBS simplifies terrain features into uniform terrain across a three-kilometer hexagon and translates locations of roads and rivers across the hex faces. This results in TEL movement that does not match realistic operational practice.
- Finally, OPTIC COBRA highlighted the need to maintain up-to-date information on both BLUE and RED assets in theater-level models. Because of a lack of up-to-date information on BLUE dispositions, CBS portrayed RED missiles targeted upon BLUE force concentrations as falling on open terrain, rather than their intended targets. This tended to devalue RED missile strikes.

Realistic portrayal of theater missile defense operations requires the development of a real-time, end-to-end simulation that can be integrated with existing theater simulations. Existing theater-level simulations do not realistically portray active defense engagements, nor can they given the volume of data they must handle. What is needed is the ability to portray TMD events more realistically within the framework of a theater campaign.

Moreover, current models do not portray the effect of TMD strikes accurately. Existing simulations do not accord sufficient effectiveness to

ballistic missiles armed with high-explosive warheads. Moreover, there is a lack of models that portray the downwind effects of missiles armed with chemical or biological warheads.

ADVANCED REAL-TIME GAMING UNIVERSAL SIMULATION

The Advanced Real-Time Gaming Universal Simulation (ARGUS) system is located at the National Test Facility (NTF) at Falcon AFB, Colorado. ARGUS is an accredited model of the Defense Support Program (DSP) satellite system and Attack, Launch, and Early Reporting to Theater (ALERT) data processor. ARGUS has also been used to simulate the Joint Tactical Ground Station (JTAGS) and Tactical Detection and Reporting (TACDAR) systems. Simulated reports are injected onto the Tactical Information Broadcasting System (TIBS) and Tactical Data Dissemination System (TDDS) as exercise messages.

EXTENDED AIR DEFENSE SIMULATION

The Extended Air Defense Simulation (EADSIM) is a multinational system simulation standard for air defense and TMD studies. Hosted on a single Unix-based workstation, it was used as a preplanning tool for DESERT STORM. EADSIM is a low-to-medium fidelity model of air and missile warfare used for scenarios ranging from few-on-few to many-on-many. Each platform (such as a fighter aircraft) is individually modeled, as is the interaction among the platforms. The model permits an analyst to evaluate system technical and operational performance, command and control, and engagement processes for selected platforms in a variety of battle scenarios. EADSIM supports architectural analysis and limited system engineering analysis, cost and operational effectiveness analysis, and acceptance testing. It is currently operated by several hundred registered users.

Theater commands participating in the CINC TMD Assessment Program have used EADSIM for both TMD system site selection and missile engagement analysis. Both U.S. Forces, Korea (USFK) and USCENTCOM have used the model to determine preferred Patriot fire unit locations. In addition, EADSIM was used during Joint Project OPTIC COBRA to model Patriot engagements. In addition, EADSIM is installed as an planning application within the USEUCOM TMD-in-a-Box.

EADSIM has several advantages as a model of active missile defenses. First, it portrays active TMD systems reasonably accurately. Hosted on a single computer, it is readily deployable for use in a field training exercise. Moreover, it is a widely-accepted analytical tool. Its main disadvantage lies in the fact that it is not a real-time model; active defense engagements must be modeled in advance. This limits its utility in a free-play environment.

SYSTEM MODELS

A number of individual sensor and weapon simulations have participated in past assessments as well.

The greatest challenge in using individual system simulations during an assessment is the need to integrate them into or coordinate them with theater-level simulations such as the ALSP Confederation, discussed above. Joint Project OPTIC COBRA 95, for example, featured the coordinated use of five different sensor simulations, all of which were to provide warning of theater missile launch. Ensuring that these simulations were synchronized and display the same missile events proved to be difficult.

CHAPTER 3
COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE (C^3I)

OVERVIEW

TMD operations demand that commanders have the ability to collect, fuse, disseminate, and act upon information very rapidly. As a result, robust and timely command, control, communications, and intelligence (C^3I) capabilities form the foundation upon which effective theater missile defense is built. The CINC TMD Assessment Program's focus on improving current capabilities to conduct theater missile defense has meant that C^3I has played a central role. A key objective of the program throughout its history has been reducing the time needed to warn the theater of ballistic missile attack. Substantial effort has also gone into improving the quality of warning data the theater receives in order to enhance passive defense, active defense, and attack operations.

This chapter describes each theater's command and control arrangements for TMD, as well as the sensors, communication paths, and data paths employed in assessments to date.

COMMAND AND CONTROL

Existing theater command and control structures have proven inadequate to conduct TMD operations. Past assessments have shown that a "TMD Cell" that is able to focus the CINC's JTMD effort is extremely valuable. If mobile, it should be self-contained and require minimal lift assets. It should have the capacity to integrate all necessary inputs (to include all available intelligence sources) and require minimum manning levels. Placement of the TMD Cell with the decision authority is critical.

Each theater participating in the CINC TMD Assessment Program has chosen to develop an operations-intelligence fusion cell dedicated to the TMD mission. U.S. European Command (EUCOM) and U.S. Forces, Korea (USFK) both established TMD fusion cells during the period covered by this report, while U.S. Central Command has established one subsequently.* This section describes the command and control of theater missile defense operations in these theaters. The conduct of attack operations, passive defense, and active defense is discussed at length in chapters 4 through 6.

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* U.S. Central Command (CENTCOM) established a TMD Cell during Joint Project OPTIC COBRA 95, conducted in May 1995. Lessons learned from this assessment will be described in the assessment final report.

U.S. EUROPEAN COMMAND

In 1994, EUCOM established a dedicated Joint Theater Missile Defense (JTMD) Cell "to facilitate the defense of critical assets against enemy tactical missile threats and attack to neutralize enemy weapon systems and their support infrastructure." The primary purpose of the JTMD Cell is to fuse operational and intelligence inputs rapidly to allow theater forces to engage short-dwell TMD targets.

During preparation for war, the JTMD Cell supports TMD operations by performing detailed threat analysis, developing rules of engagement, and conducting wargaming. During the transition to war, the cell would conduct intelligence preparation of the battlespace (IPB), establish early warning nets, and deploy TMD assets. In wartime, the cell would provide warning of missile attacks, coordinate the engagement of hostile ballistic missiles, search out and destroy enemy missile assets, attack enemy missile infrastructure, and refine battle damage assessment (BDA) reports.

The JTMD Cell is designed so that it can operate as part of the air, land, or sea components of a joint task force at any echelon of command. During TRAILBLAZER II and ATLANTIC RESOLVE, for example, the JTMD Cell was integrated into a Joint Forces Air Component Command (JFACC) organization. The former exercise reinforced the need to develop, document, and train with a standard operating procedure (SOP) for employing a TMD Cell in support of a JFACC. It also showed that the TMD Cell needs close ties to the intelligence collection and production elements supporting the JFC. The JTMD Cell is also capable of operating within a NATO command structure. During DYNAMIC GUARD, for example, the JTMD Cell was subordinated to NATO's Allied Forces, Southern Region (AFSOUTH).

The EUCOM JTMD Cell is equipped with "TMD-in-a-Box", an integrated hardware and software suite configured in two S-250 shelters for rapid deployment to and within a theater of operations. During AFRICAN EAGLE, the EUCOM JTMD Cell demonstrated the ability to receive Tactical Digital Information Link A (TADIL-A), Tactical Information Broadcast System (TIBS), and Tactical Data Distribution System (TDDS) broadcasts; transmit over UHF satellite communications (SATCOM); receive Joint Tactical Ground Station (JTAGS) data, and receive weather and Global Positioning System (GPS) data. The cell received JTAGS missile tracks and automatically fed them to the Generic Area Limitation Environment (GALE) for refinement. The cell also demonstrated the ability to fuse TADIL-A, TIBS, TDDS, and Officer in Tactical Control Information Exchange System (OTCIXS) data into one situational overlay. During the exercise the cell fused weather data with predicted impact points from JTAGS to produce predicted nuclear, biological, and chemical (NBC) fallout footprints. These were transmitted to naval units participating in the exercise.

U.S. FORCES, KOREA

Combined Forces Command (CFC)/U.S. Forces, Korea (USFK) established its TMD Cell in 1993. The CFC/USFK TMD Cell is subordinated to Commander, 7th Air Force, the theater's Joint Forces Air Component Commander (JFACC). The TMD Cell itself is located in the Hardened Tactical Air Command Center (HTACC) at Osan Airbase. During ORNATE IMPACT II, the TMD Cell was equipped with an Air Defense Systems Integrator (ADSI) terminal to display missile warning data, a telephone and UHF SATCOM radio to receive voice warning, two GALE terminals for terrain limitation and movement modeling, and a Contingency Tactical Air Control System Automated Planning System (CTAPS) work station to task assets for attack operations.

During Joint Project ORNATE IMPACT II, the USFK TMD Cell conducted intelligence preparation of the battlefield (IPB) to support the development of the Single Prioritized Integrated Target List (SPITL), pre-Integrated Tasking Order (ITO) and ITO. These efforts focused upon both short-dwell targets and TMD infrastructure. However, because the USFK TMD Cell is not a permanent entity, cohesiveness was lacking. Moreover, as Chapter 4 notes, the exercise demonstrated the need for improvement in the areas of IPB, automation, resource allocation, and weapon assignment.

DATA NETWORKS

TMD levies some stringent requirements upon theater voice and data communications architectures. The CINC TMD Assessment Program has examined the utility of the full range of existing communication networks in support of TMD operations. Every assessment to date has featured some sort of communications problem — be it degraded capabilities due to equipment not being available or the inability of one part of the architecture to correctly connect with another part. Redundant communication networks will thus be critical to the success of TMD operations

Tactical Data Links

Tactical data links provide the means to exchange data between individual sensors and weapon platforms. The CINC TMD Assessment Program has explored the following tactical data links:

- LINK 11, is a secure, netted link for exchanging digital information among airborne, land based, and shipborne tactical data systems. It is capable of broadcasting data in the HF or UHF bands at 2400 baud in TADIL A format. LINK 11 is used by NTDS ships as well as E-2C, P-3, and S-3 aircraft.
- LINK 11B is the joint standard link designed to provide digital data between ground-based air defense elements. Data is broadcast to stationary sites in the TADIL B format.

- OTCIXS provides near-real-time ship-to-ship or ship-to-shore data exchange over tactical satellite communication channels. OTCIXS is designated as the primary communication system for naval battle groups to exchange over-the-horizon targeting (OTH-T) information.

Landlines

EUCOM, USFK, and U.S. Forces, Japan (USFJ) have all used landline communications to transmit both secure and unsecure voice warning of missile attack to fixed sites within the theater. EUCOM also used commercial telephone lines to disseminate voice warning during DYNAMIC GUARD.

Landlines have several advantages. They are inexpensive relative to satellite communications and are immune to jamming. Their main disadvantage is their susceptibility to physical destruction. In theaters such as Korea, where enemy SOF action can be expected, landlines alone may be insufficient to provide assured TMD warning. Moreover, the telephone systems of some countries may be too austere to pass voice and data warning in a timely and reliable manner.

Satellite Communications

EUCOM, CENTCOM, USFK, and USFJ have used SATCOM to transmit voice and data warning during TMD assessments. In general, SATCOM provides a timely and reliable means of transmitting warning to theater combatants. However, it also has several disadvantages. Because UHF SATCOM receivers are expensive, it may be difficult to equip all units with a dedicated receiver for TMD warning. In addition, TMD warning must compete with other theater communications needs for SATCOM bandwidth. During ATLANTIC RESOLVE, for example, EUCOM was forced to use a dedicated DSN line to disseminate voice warning because the normal JTMD Cell UHF SATCOM channel was being used to support real-world operational requirements.

INTELLIGENCE

The ability to detect ballistic missile launches quickly and accurately undergirds effective passive defense, active defense, and attack operations. The CINC Assessment Program has evaluated the utility of a range of sensors and processors in support of TMD operations

SENSORS AND PROCESSORS

Defense Support Program

The Defense Support Program (DSP) satellites provide detection and warning of ballistic missile launch. Three processors have been fielded to refine DSP sensor inputs to produce more accurate and timely warning. These are:

- JTAGS, formerly known as the Tactical Surveillance Demonstration (TSD), a mobile, in-theater processor;

- Attack, Launch, and Early Reporting to Theater (ALERT), formerly known as TALON SHIELD, a centralized, CONUS-based processor; and
- Tactical Detection and Reporting (TACDAR), formerly known as RADIANT IVORY.

Together, these processors form the U.S. Space Command (USSPACECOM) Tactical Event System (TES) for missile warning. Broadcast over TIBS and TDDS, TES reports provide units with early warning of missile attack, including estimated launch point, azimuth, impact point, and impact time. As OPTIC COBRA 94 demonstrated, the dissemination of launch reports from multiple processors over both TIBS and TDDS minimizes the possibility that a launch will go unreported. Exercises in EUCOM and USFK have also shown, however, that multiple, uncorrelated launch reports can lead to confusion and hamper attack operations planning.

The greatest advantage of the DSP system is that it provides near-global coverage of theater and strategic missile launches. Unfortunately, however, the design of the DSP sensor limits the accuracy with which it can predict launch and impact points.

Past assessments have sought to increase the speed with which DSP data is passed to and throughout the theater for use in passive defense, active defense, and attack operations. Moreover, assessments have also examined the utility of terrain limitation systems, such as GALE, described below, to refine DSP data to improve the effectiveness of attack operations.

Airborne Surveillance Testbed

The Army's Airborne Surveillance Testbed (AST) provides an airborne infrared detection and tracking capability. AST participated in JTF-95, and its capabilities were simulated during the Kitty Hawk Battle Group TMD exercise. The primary drawbacks of the aircraft are its long logistical tail and its vulnerability to enemy aircraft or long-range surface-to-air missiles (SAMs).

COBRA BALL

COBRA BALL, while primarily a national intelligence asset for collecting science and technology intelligence, also has the ability to provide warning and tracking of TBM events to theater users as well. COBRA BALL's capabilities were simulated during ATLANTIC RESOLVE. While COBRA BALL can collect valuable data for TMD, theater personnel had difficulty coordinating missions with theater intelligence organizations.

U-2R

U-2 aircraft possess a number of sensors that can make a valuable contribution to the TMD mission. The U-2 has been used to search for missile TELs, both autonomously and using external cues. The aircraft has also been used to image suspected TEL hide sites and garrisons. During

QUIET SUNSET, for example, U-2 aircraft passed imagery to the Echelon-Above-Corps Intelligence Center (EACIC) for use in targeting enemy TELs. Individual assessment reports contain more detailed descriptions of the capabilities and limitations of the U-2 in the TMD role.

SPY-1 Radar

The SPY-1 phased array radar aboard AEGIS cruisers and destroyers demonstrated the capability to detect and track theater ballistic missiles during the Gulf War. Moreover, the OPTIC NEEDLE connectivity exercise demonstrated the capability to export an air picture developed by an AEGIS ship to a *Patriot* unit. During DYNAMIC GUARD, the EUCOM JTMD Cell passed missile early warning cueing data to an AEGIS cruiser.

SPY-1's capability to detect and track ballistic missiles is not fully operational, however. As currently configured, the radar's performance is optimized for tracking airbreathing targets. While a software patch is currently available to improve the radar's ability to track ballistic targets, modified software will not be available for several more years.

TPS-75 Radar

During JTF-95, the Air Force's TPS-75 battlefield radar's Expert Missile Tracker (EMT) was used to detect and track live ballistic missile launches. The primary operational consideration for the employment of the system is deployment to both allow it to view missile launches while also limiting its vulnerability to enemy defense suppression efforts.

TPS-59 Radar

The Marine Corps TPS-59 battlefield radar was also employed during JTF-95. It faces operational considerations similar to those of the TPS-75.

National Systems

National systems have been used to support TMD operations throughout the history of the CINC TMD Assessments Program.* National systems have the ability to provide unique indicators and warning of imminent ballistic missile use. They also have the ability to assist in attack operations. While the intelligence community has made great strides in improving the timeliness of national products to the theater, in some cases it fails to meet the extremely stringent timelines required to conduct TMD operations. The security classification of products of national systems can also reduce their utility. Restrictions on the release of certain categories of classified material can be especially challenging in a multinational environment.

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* The mission and capabilities of these systems limits the amount of information that can be disclosed in an unclassified document. Please consult reports of individual assessments for a discussion of the role and performance of national systems.

Special Operations Forces

Special Operations Forces (SOF) can be a valuable source of targeting data for attack operations.** One lesson of the Gulf War is the need to develop the means for timely data exchange between TMD elements and SOF units in the field.

TACTICAL DATA PROCESSORS

A tactical data processor is a piece or system of electronic equipment that receives, stores, processes, displays, and/or transmits C^3I information. In most cases, it does not stand alone, but has at least one sensor or broadcast input.

TIBS and TDDS Processors

The CINC TMD Assessment Program has utilized several different processors of TIBS and TDDS data. These include the following:

- *Graphic Intelligence Support Terminal.* The Graphic Intelligence Support Terminal (GIST) is a receive-only terminal capable of processing and displaying TDDS data. It is designed for use by forward-deployed units without a more robust capability. During Joint Project ORNATE IMPACT II, it was used in combination with RADIANT MERCURY to display missile warning data in a combined operational environment.
- *Standard Tactical Receive Equipment Display.* The Standard Tactical Receive Equipment Display (S-TRED) uses a DOS software package to provide a graphically-oriented control system to configure filter settings to display TDDS data. These filters allow data processors to process TDDS faster and more efficiently. Because the S-TRED software is relatively inexpensive and does not have sophisticated hardware requirements, S-TRED units have been used to provide warning to units which do not possess more sophisticated processors.
- *Forward Area Support Terminal.* The Forward Area Support Terminal (FAST) is an Army TDDS and secondary imagery receiver.
- *Commander's Tactical Terminal.* The Commander's Tactical Terminal (CTT) is an Army data processor for handling TIBS and TDDS data. It comes in two varieties: the Commander's Tactical Terminal Hybrid (CTT H), which can both receive and transmit TIBS and TDDS data, and the CTT H/Receive Only (CTT H/R), which lacks the ability to transmit.
- *CONSTANT SOURCE Operator's Terminal.* The CONSTANT SOURCE Operator's Terminal (CSOT) is an Air Force processor that has the ability to receive TIBS and TDDS data.

Air Defense Systems Integrator

The Air Defense Systems Integrator (ADSI) is programmed as a multi-function data link buffer that receives message traffic in multiple formats and

** As Chapter 4 notes, they can also be used to take direct action against TELs as well.

various TADIL formats and converts this information to protocols and formats acceptable to TADIL-B or other tactical command and control outputs. Both EUCOM and USFK utilize ADSI to display a common air picture for TMD.

RADIANT MERCURY

RADIANT MERCURY is a Navy Tactical Exploitation of National Capabilities (TENCAP) program that is designed to permit multi-level data processing over a single data network. During Joint Project ORNATE IMPACT II, for example, RADIANT MERCURY was used to sanitize U.S.-only data so that it could be displayed in a combined U.S.-Republic of Korea (ROK) environment. The system's low data rate incurred significant delays in displaying TMD warning data in combined areas, however.

Generic Area Limitation Environment

The Generic Area Limitation Environment (GALE) is a software suite used to refine TBM launch data for attack operations. The software can be used to conduct IPB as well. EUCOM, for example, uses GALE to generate refined launch point estimates, TEL movement routes, and potential hide sites. GALE receives launch point estimates and refines them using two models: a terrain model that determines what terrain is suitable for TBM transporter-erector-launchers (TELs), and a movement model that portrays the distance that TELs can move over time.

Recent assessments have demonstrated the need to automate the process of importing data into, and exporting data from, GALE. During Joint Project ORNATE IMPACT II, for example, the GALE operator was forced to enter estimated launch points into GALE for analysis, a slow process that limited the number of launch points that could usefully be analyzed. Similarly, while EUCOM has automated the feed of DSP data to GALE, it has yet to automate the export of GALE data to mission planning systems such as CTAPS. As a result, during ATLANTIC RESOLVE target nominations were hand-carried from GALE to strike planners, a process that wasted precious time.

CHAPTER 4
ATTACK OPERATIONS

OVERVIEW

Attack operations was the principle concept area upon which the JTMD Experiments Program was originally founded. Given the short timelines associated with TBM operations, attacking missile launchers has proven to be a difficult task. The Gulf War highlighted our inability to conduct effective attack operations. Since then, several theaters have made progress in developing concepts of operations and procedures for destroying TBM targets. Still, there is much left to be done.

TACTICS, TECHNIQUES, AND PROCEDURES

U.S. EUROPEAN COMMAND

U.S. European Command (USEUCOM) developed and refined procedures to conduct attack operations during TRAILBLAZER II and ATLANTIC RESOLVE. The EUCOM TMD Cell receives initial warning of missile launch over a Joint Tactical Ground Station (JTAGS) remote. Launch point estimate data from JTAGS is automatically fed into the Generic Area Limitation Environment (GALE) system, where it is combined with topographic data to produce refined launch point estimates, TEL movement routes, and potential hide sites. The GALE operator transcribes these locations onto a target recommendation form, which is then provided to an execution element for weapon assignment.

ATLANTIC RESOLVE demonstrated the need to automate the target nomination and assignment process. During the exercise, target nominations were distributed to execution elements by hand on sheets of paper. Such a procedure wasted precious time. Automating the feed of refined TBM launch data to the Advanced Field Artillery Target Data System (AFATDS)/Automated Deep Operations Coordination System (ADOCCS), for example, would have increased the timeliness of Army Tactical Missile System (ATACMS) employment against TBM launch sites. It might also be worthwhile to investigate establishing automated links to mission planning system as the Contingency Tactical Air Control System Automated Planning System (CTAPS).

U.S. FORCES, KOREA

U.S. Forces, Korea (USFK) attack operations are the responsibility of the TMD Cell located at the Hardened Tactical Air Control Center (HTACC), at Osan Airbase. During Joint Project ORNATE IMPACT, USFK developed set of standard operating procedures and supporting C3I architecture to increase the timeliness of data dissemination in support of attack operations. These procedures were revised and subsequently demonstrated during Joint Project ORNATE IMPACT II, held in Korea during August 1994.

The USFK TMD Cell uses Defense Support Program (DSP) data processed by JTAGS, Attack, Launch, and Early Reporting to Theater (ALERT), or Tactical Detection and Reporting (TACDAR) to derive an estimated missile launch point. During Joint Project ORNATE IMPACT II, this information was entered into GALE for refinement and then passed on to execution elements for weapon assignment. Whereas USEUCOM's TMD Cell has automated the process up to target recommendation, USFK did not possess such automated links at the time of ORNATE IMPACT II. As a result, estimated launch points had to be manually entered into GALE and potential targets hand-carried to the BCE. USFK plans to install a fiber-optic network connecting TMD Cell components to increase the speed of the process.

Joint Project ORNATE IMPACT II demonstrated that TBM targets may not have a high priority in a general theater campaign. In fact, execution elements rejected every single TBM target nominated by the Korean Combined Operational Intelligence Center (KCOIC) in favor of higher priority operational targets. Moreover, limitations on attacking TBM TELs based on launch detection effectively precluded the conduct of attack operations early on.

USFK planning assumes that no aircraft will be available for attack operations, at least initially. As a result, the command relies heavily upon ATACMS for attack operations. During ORNATE IMPACT II, the time from receipt of estimated launch points to release of refined locations by GALE was five minutes or less. The theater's pre-fire coordination requirement for ATACMS nevertheless precluded use of the weapon based on information from the TMD Cell.

The exercise also highlighted the need to perform adequate Intelligence Preparation of the Battlefield (IPB) in support of TMD operations. The TBM Target Set Reference Materials, prepared by the 7th Air Force, identified Scud-related installations and industrial infrastructure in North Korea. Some of these targets were included in pre-Integrated Tasking Order (ITO) strike packages by the Combined Targeting Board (CTB) and some were struck early on. However, the targeting effort focused more on lines of communications (LOC) than on infrastructure targets. While the KCOIC TMD Targeting Cell provided the CTB with a significant number of TBM infrastructure targets, these nominations were rejected in favor of higher-priority operational targets. The development of a counter-Scud campaign plan, including support infrastructure and LOC interdiction targets, will be explored during Joint Project ORNATE IMPACT III.

U.S. Central Command

U.S. Central Command did not begin to explore attack operations within the CINC TMD Assessments Program until Joint Project OPTIC

COBRA 95, conducted in May 1995. Lessons learned from this assessment will be described in the assessment final report.

ASSETS FOR ATTACK OPERATIONS

ARMY TACTICAL MISSILE SYSTEM

EUCOM assessments have also shown ATACMS to be an extremely responsive asset for attack operations. As TRAILBLAZER II demonstrated, appropriate target sets, engagement criteria, Joint and Army employment doctrine and airspace control measures are needed to maximize ATACMS operational potential.

In ATLANTIC RESOLVE, AFATDS procedures hindered the effective employment of ATACMS. While the TMD Cell provided Scud data in a timely manner, confusion over ATACMS firing procedures eliminated opportunities to kill TELs. Procedures were refined as the exercise progressed and AFATDS was eventually able to respond in a timely manner to TMD Cell-provided information.

Another constraint on the effectiveness of ATACMS is its limited range relative to that of TBMs. This calls for ATACMS to be moved forward to engage TBM launchers. During ATLANTIC RESOLVE, the Joint Force Commander (JFC) proved unwilling to move his ATACMS forward; as a result, they were unable to range enemy TBM launchers.

The ATACMS is USFK's weapon of choice for TMD attack operations because of its flexibility. Moreover, ORNATE IMPACT II demonstrated the value of FDDM for support of skip-echelon ATACMS tasking. However, the exercise demonstrated the need to streamline theater coordination procedures to ensure that ATACMS can be employed against short-dwell targets.

STRIKE AIRCRAFT

USEUCOM assessments have demonstrated the need to dedicate strike aircraft to the TMD mission. During ATLANTIC RESOLVE, it initially proved difficult to get aircraft assigned to TBM targets. Once the JFC decided to dedicate air resources to the TMD battle, however, response times decreased appreciably.

Strike aircraft play a more limited role in attack operations in the Korean theater. In the initial days of Joint Project ORNATE IMPACT II, higher priority operational tasking precluded commitment of strike aircraft to TEL strike missions based on TMD Cell-provided launch location reporting. It was very difficult to "re-role" aircraft once they had their mission specified by the ITO.

Special Operations Forces

Assessments in both Korea and Europe have shown that Special Operations Forces (SOF) can play an important role in conducting deep reconnaissance, target designation, and direct action against TBM infrastructure and TEL targets. One recommendation to come out of Joint Project ORNATE IMPACT II was that plotting the position of SOF teams in the GALE system would aid in the correlation of their reports and speed up the process of getting accurate targeting information to the shooters.

CHAPTER 5
PASSIVE DEFENSE

OVERVIEW

U.S. European Command (USEUCOM); U.S. Central Command (USCENTCOM); U.S. Forces, Korea (USFK); and U.S. Forces, Japan (USFJ) have all assessed their ability to receive and disseminate warning of impending missile attack. This chapter provides an overview of each command's passive defense procedures and describes insights gained from recent assessments.

TACTICS, TECHNIQUES, AND PROCEDURES

U.S. EUROPEAN COMMAND

The USEUCOM concept for passive defense calls for the theater's TMD Cell to disseminate voice warning to the theater based upon launches reported by the Joint Tactical Ground Station (JTAGS). Given that the TMD Cell could be called upon to deploy to any part of the EUCOM area of responsibility, the TMD Cell is capable of using a variety of communication networks, including Ultra-High Frequency (UHF) Satellite Communication (SATCOM) and landline.

DYNAMIC GUARD demonstrated EUCOM's ability to pass TMD voice warning to both U.S. land, sea, and air units as well as allied forces using an austere communications infrastructure. Voice warning to U.S. components utilized secure UHF SATCOM circuits, while warning to Turkish forces used an unsecure High Frequency (HF) network.

During ATLANTIC RESOLVE, EUCOM was forced to transmit voice warning over a dedicated Defense Switched Network (DSN) line because use of UHF SATCOM was pre-empted by U.S. operations in Haiti. The lack of UHF SATCOM circuits hindered EUCOM's ability to pass warning information to the full range of exercise participants. Moreover, the exercise demonstrated the need to develop standard operating procedures for missile warning that can be distributed to forces in the field. During the exercise, for example, voice warning recipients were unaware of the format of voice warning messages and actions they were required to take.

U.S. FORCES, KOREA

USFK passive defense procedures call for an operator manning the in-theater JTAGS unit to initiate voice warning to key elements of the command over a dedicated secure auto-dial telephone network and the CINC One SATCOM network.

Joint Project ORNATE IMPACT II revealed problems with the USFK voice warning architecture. During the exercise, the JTAGS operator had to wait between 90 and 105 seconds to initiate voice warning while all parties on the auto-dial conference call network picked up their phone. USFK plans to install speaker phones at conference call locations to decrease warning timelines. However, as the net expands, speed drops, making it imperative that new subscribers be equipped with speaker phones as well.

UHF SATCOM dissemination of voice warning proved to be rapid and reliable during ORNATE IMPACT II. Moreover, UHF SATCOM broadcast provides the only means of dissemination to such augmenting forces as the U. S. Marine Corps forces. However, most augmenting commands or units do not deploy with a UHF SATCOM downlink capability.

The use of a grid reference system to pass voice warning created some confusion during the exercise. During part of the exercise, the current peninsula air defense sectors were used to warn subordinate units that they were under attack. At other times, warning broadcasts specified assets at risk from missile attack. USFK is incorporating the results of ORNATE IMPACT II into planning for ORNATE IMPACT III in 1995.

Dissemination of warning to Republic of Korea government and to the U. S. government dependent-population was to have been another objective of the exercise. In the end, however, the issue was not examined.

U.S. FORCES, JAPAN

USFJ exercised its capability to receive voice warning during KEEN EDGE 94. Prior to the exercise the command established a DSN early warning network. During the exercise, voice early warning was passed over non-secure DSN phone lines from the U.S. Space Command (USSPACECOM) Missile Warning Center in CONUS to USFJ and 5 AF Command Centers. USFJ then initiated a conference call to the Service Components and echoed the message received from USSPACECOM. A second network utilized the USPACOM CINC One UHF SATCOM network to provide voice warning to elements which were not necessarily connected to the DSN net, such as Seventh Fleet ships at sea.

U.S. CENTRAL COMMAND

CENTCOM first established a passive defense architecture during Joint Project OPTIC COBRA 94. There were, however, initially no established procedures for the Joint Task Force (JTF) to provide subordinate units with voice warning. The Joint Force Commander (JFC) eventually delegated the responsibility of disseminating voice warning to the Echelon-Above-Corps (EAC) Air Defense Artillery (ADA) brigade. Procedures were subsequently developed for TMD voice warning over UHF SATCOM radios to selected JTF headquarters.

OPTIC COBRA demonstrated the importance of redundant warning paths. Some units missed missile events because they relied upon a single warning broadcast which subsequently failed. Moreover, JTAGS and TALON SHIELD used different ephimeris data while processing TBM launch information. This caused the systems to provide impact point predictions that differed, sometimes by a considerable distance. This caused confusion as to how many missiles had been fired and where they would land.

Timeliness of early warning proved to be an issue during the exercise. It took two to three minutes after launch to pass early warning to all subordinate headquarters. As a result, these units had very little reaction time. Nor were there any planned backup notification procedures. CENTCOM has subsequently recognized the need to bring the Control and Reporting Center (CRC) and Air Operations Center (AOC) into the TMD voice warning network to provide redundancy for theater early warning. Also, initially there were no procedures established for JTAGS operators to initiate voice EW.

CHAPTER 6
ACTIVE DEFENSE

OVERVIEW

U.S. European Command (USEUCOM); U.S. Central Command (USCENTCOM); and U.S. Forces, Korea (USFK) have all evaluated their capability to pass timely voice and data warning to active theater missile defense units. This chapter describes each command's active defense procedures and outlines insights from recent assessments.

TACTICS, TECHNIQUES, AND PROCEDURES

U.S. EUROPEAN COMMAND

The Joint Tactical Ground Station (JTAGS) remote located within the EUCOM Joint TMD Cell serves as the originator of warning data for the theater. JTAGS disseminates warning data over both the Tactical Information Broadcast System (TIBS) and the Tactical Data Dissemination System (TDDS). In addition, JTAGS transmits warning data to an Air Defense Systems Integrator (ADSI) co-located with the Modular Control Element (MCE), where it is translated into Tactical Data Link (TADIL)-B format and re-broadcast to Patriot units. Exercise experience shows, however, that such an architecture, which requires multiple data translations, can introduce errors into the data warning path and reduce the reliability of the warning to Patriot units. During ATLANTIC RESOLVE, EUCOM also demonstrated the capability to provide voice cueing to Patriot units to allow them to assume defensive postures. TIBS data was received soon after, ensuring that only those radars within the target area radiated.

DYNAMIC GUARD demonstrated the need to enhance interoperability with allied active defense systems. Software incompatibility between U.S. C3I systems and Dutch and German Patriot systems, for example, proved to be a major impediment to passing timely warning to allied active defense units. Neither the Dutch nor the Germans are currently authorized access to the TIBS and TDDS broadcasts. Work-arounds were required to allow allied units to receive missile track data. Even so, at no time did Dutch or German air defense units receive a complete set of missile data (e.g., launch point estimate, impact point estimate, missile speed, azimuth, altitude, and type).

U.S. FORCES, KOREA

Joint Project ORNATE IMPACT II provided USFK with an opportunity to assess its procedures for passing warning data to active defense units. The USFK TMD Cell recieves warning data from the TIBS and TDDS broadcasts via a CONSTANT SOURCE Operator's Terminal (CSOT). This data is translated into TADIL-B format by an ADSI and then broadcast to Patriot units. During the exercise, the Patriot Batallion Tactical Operations Center (BTOC) was hard-wired directly to the JTAGS feed as well.

The exercise revealed the need to develop standard operating procedures to govern Patriot employment in Korea. For example, the state of readiness (SOR) of Patriot units was not always correlated to the theater defensive condition (DEFCON). The excercise also showed the need to more clearly define the role of Army Air Defense Artillery brigades and Air Force Control and Reporting Center (CRC) in the command and control of TBM engagements. USFK is taking steps to ensure that a Patriot liaison officer is located at the TMD Cell to improve coordination between the theater and individual active defense units.

U.S. CENTRAL COMMAND

CENTCOM first examined its active defense procedures during Joint Project OPTIC COBRA in 1994. During the exercise, JTAGS and TALON SHIELD provided TBM data over TIBS and TDDS, generally within 80 seconds of missile launch. JTAGS was employed in automatic mode, while TALON SHIELD was used in the manual mode. JTAGS data was generally faster, but would occasionally fail to report a launch that did not fit a specified profile. TALON SHIELD was slower, but provided data when it was omitted by JTAGS.

During the exercise, the CRC lacked the ability to alert Patriot units selectively. As a result, RED forces could launch a single TBM and determine the location of all Patriot emitters. As the exercise progressed, however, brigade and battalion headquarters learned to step in and instruct only those firing units with the capability to engage an incoming missile to begin radiating.

The 11th ADA Bde received the only Air Defense Tactical Operations Center (ADTOC) used in the exercise. The ADTOC gave the brigade the ability to integrate all TBM and airbreathing threat information using the ADSI. Three ADSI terminals capable of independent display and control gave them the ability to command and control the air battle from the ADTOC. Patriot battalions received voice and data warning of TBM launches, generally in sufficient time to react. They did, however, experience reliability problems with the Standard Tactical Receive Equipment Display (S-TRED).

GLOSSARY OF ACRONYMS

AAR	After Action Review
ACC	Air Combat Command
ACE	Analysis Control Element
ACS	Air Control Squadron
AD	Active Defense
ADA	Air Defense Artillery
ADOCCS	Automated Deep Operations Coordination System
ADSI	Air Defense Systems Integrator
ADTOC	Air Defense Tactical Operations Center
AFAS	Army Field Artillery School
AFTADS	Advanced Field Artillery Target Data System
AFSOUTH	Allied Forces South
AFSPACECOM	Air Force Space Command
ALCM	Air Launched Cruise Missile
AO	Attack Operations
AOC	Air Operations Center
ARFOR	Army Forces
ARGUS	Advanced Real-Time Gaming Universal Simulator
ARSPACECOM	Army Space Command
ARTEP	Army Training and Evaluation Program
AR 94	Exercise Atlantic Resolve 94
ASARS	Advanced Synthetic Aperture Radar System
ASAS	All Source Analysis System
ASB	Army Science Board
AST	Airborne Surveillance Testbed
ATACMS	Army Tactical Missile System
ATO	Air Tasking Order
AWACS	Airborne Warning and Control System
AWSIM	Air Warfare Simulator
BCE	Battlefield Coordination Element
BDA	Battle Damage Assessment
BICM	Battlefield Intelligence Collection Model
BM/C4I	Battle Management/Command & Control, Communications, Computers and Intelligence
BMDO	Ballistic Missile Defense Organization
BTOC	Battalion or Brigade Tactical Operations Center
CAC	U.S. Army Combined Arms Center
CACC	Combined Air Control Center
CAP	Combat Air Patrol

CBS	Corps Battle Simulation
CC	Command Center
CEC	Cooperative Engagement Capability
CEP	Circular Error Probable
CFC	Combined Forces Command
CINC	Commander in Chief
CM	Cruise Missiles
COMINT	Communications Intelligence
COMSIXFLT	Commander 6th Fleet
CONOPS	Concept of Operations
CONUS	Continental United States
COT	Contingency Operations Team
CP	Command Post
CPX	Command Post Exercise
CRC	Control and Reporting Center
CS	Constant Source
CSOT	Constant Source Operator Terminal
CSS	Combat Service Support
CTAPS	Contingency Tactical Air Control System Automated Planning System
CTB	Combined Targeting Board
CTC	Combined Targeting Center/Cell
CTG	Combat Target Graphic
CUWTF	Combined Unconventional Warfare Task Force
C2	Command & Control
C4I	Communications, Command & Control, Computers, and Intelligence
DARPA	Defense Advanced Research Project Agency
DCSCD	Deputy Chief of Staff for Combat Developments
DCSINT	U.S. Army Deputy Chief of Staff for Intelligence
DCSLOG	U.S. Army Deputy Chief of Staff for Logistics
DCSOPS	U.S. Army Deputy Chief of Staff for Operations
DEFCON	Defense Readiness Condition
DIA	Defense Intelligence Agency
DISC-4	Director of Information Systems
DISE	Deployable Intelligence Support Element
DoD	Department of Defense
DRSN	Defense Red Switch Network
D&SA	Depth and Simultaneous Attack
DSCS	Defense Satellite Communications System
DSN	Defense Switching Network
DSP	Defense Support Program
EACIC	Echelons above Corps Intelligence Center

EJTADS	Enhanced Joint Tactical Army Data Information Link Distribution System
ELINT	Electronic Intelligence
EW	Early Warning
EWC	Early Warning Center
EXCAP	Exercise Capability
FDC	Fire Direction Center
FDDM	Fire Direction Data Manager
FOFA	Follow-on Forces Attack
FORSCOM	U.S. Army Forces Command
FSCOORD	Fire Support Coordinator
FSOP	Field SOP
FSST	Forward Space Support Team
FTX	Field Training Exercise
FY	Fiscal Year
GALE	Geographic Area Limitation Environment
GIST	Graphical Intelligence Support Terminal
GOSC	General Officer Steering Committee
GSM	Ground Station Module
HF	High Frequency
HQDA	Headquarters, Department of the Army
HQ, USAF	Headquarters, U.S. Air Force
HQ, USAFE	Headquarters, U.S. Air Forces Europe
HQ, USN	Headquarters, U.S. Navy
HTACC	Hardened Tactical Air Control Center
HUMINT	Human Intelligence
IADS	Integrated Air Defense System
ICTT	Improved Commanders Tactical Terminal
IMINT	Imagery Intelligence
INTSUMS	Intelligence Summaries
IPB	Intelligence Preparation of the Battlefield
IPDS	Imagery Processing and Dissemination Systems
IPL	Integrated Priority List
IPR	In process Review
ISARS	Improved Synthetic Aperture Radar System
ITO	Integrated Task Order
JAC	Joint Analysis Center
JCS	Joint Chiefs of Staff
JFACC	Joint Force Air Component Commander
JFC	Joint Forces Commander
JMCIS	Joint Maritime Command Information System

JOC	Joint Operations Center
JPI	Joint Precision Interdiction
JPOC	Joint Project Optic Cobra (USCENTCOM)
JPOI	Joint Project Ornate Impact (USFK)
JPON	Joint Project Optic Needle
JSDF	Japanese Self Defense Force
JSTARS	Joint Surveillance and Target Attack Radar System
JTADS	Joint TADIL-A Distribution System
JTAGS	Joint Tactical Ground Station
JTF	Joint Task Force
JTMD	Joint Theater Missile Defense
JTTP	Joint Tactics, Techniques and Procedures
KCOIC	Korean Combined Operations and Intelligence Center
KHBG	USS Kitty Hawk Battle Group
KTA	Korean Telegraph Agency
KTO	Korean Theater of Operations
LAN	Local Area Network
LANDSAT	Land Satellite
LOC	Lines of communication
LOCE	Linked Operations - Intelligence Center Europe
MACOM	Major Army Command
MAGTF	Marine Amphibious Group Task Force
MASINT	Measurements & Signatures Intelligence
MAU	Marine Amphibious Unit
MCE	Modular Control Element
MIPR	Military Interdepartmental Purchase Request
MSI	Multispectral Imagery
NATO	North Atlantic Treaty Organization
NAVSPACECOM	Naval Space Command
NBC	Nuclear, Biological and Chemical
NMD	National Missile Defense
NSA	Nuclear Security Agency
NTDS	Navy Tactical Data System
NTF	National Training Facility
NWARS	National Wargaming System
OMA	Operations and Maintenance Army
OSD	Office of the Secretary of Defense
OTCIXS	Officer in Tactical Control Information Exchange System
PAWS	Portable All Source Analysis Work Station
PD	Passive Defense

PEO-CCS	Program Executive Officer - Command and Control Systems
PIE	Peninsula Intelligence Estimate
POC	Point of Contact
RAP	Recognizable Air Picture
R&D	Research and Development
RESA	Research, Evaluation, and Systems Analysis
RFI	Request For Information
ROE	Rules of Engagement
ROK	Republic of Korea
RPVs	Remotely Piloted Vehicles
RSTA	Reconnaissance, Selection, and Target Acquisition
RTCE	Remote Targeting Capabilities Europe
SACEUR	Supreme Allied Commander Europe
SADO	Senior Air Operations Duty Officer
SATCOM	Satellite Communications
SDIO	Strategic Defense Initiative Organization
SIGINT	Signal Intelligence
SODO	Senior Operations Duty Officer
SOP	Standard Operating Procedures
SOW	Statement of Work
SPITL	Single Prioritized Integrated Target List
SPOT	Satellite Probatoire de LíObservation de la Terre
SPQS	Special Project Quiet Sunset
SPTS	Special Project Torpid Shadow
SSDC	U.S. Army Space and Strategic Defense Command
SSM	Surface to Surface Mode
STICS	Scaleable Transportable Intelligence Communications System
STOW-E	Synthetic Theater of War - Europe
STRED	Standard Tactical Receive Equipment Display
SWA	Southwest Asia
TACDAR	Tactical Detection and Reporting
TACNAT	Tactical use of National Technical means
TACSIM	Tactical Level Collection System Simulation
TAD	Theater Air Defense
TADIL-A,B,J	Tactical Digital Information Links (A, B, and J)
TADIX	Tactical Data Information Exchange System
TAOC	Tactical Air Operation Center
TBM	Tactical Ballistic Missile
TBMDX	Tactical Ballistic Missile Defense Exercise
TDDS	Tactical Data Distribution System
TEL	Transporter - Erector - Launcher

TENCAP	Tactical Exploitation of National Capabilities
TERS	Tactical Event Reporting System
TEXCOM	U.S. Army Test and Experimentation Command
TFW	Tactical Fighter Wing
THAAD	Theater High Altitude Area Defense
TIBS	Tactical Information Broadcast System
TMD	Theater Missile Defense
TMDEX	Tactical Missile Defense Exercise
TMDI	Tactical Missile Defense Initiative
TMDSTF	Tactical Missile Defense Special Task Force
TOC	Tactical Operations Center
TPFDL	Time Phased Force Development List
TPT	Theater Planning Tool
TRADOC	U.S. Army Training and Doctrine Command
TRAP	Tactical Receive and Related Applications
TRE	Tactical Receive Equipment
TTP	Tactics, Techniques and Procedures
UAV	Unmanned Aerial Vehicle
UHF	Ultra High Frequency
UIES	USAREUR Imagery Exploitation System
USAADASCH	U.S. Army Air Defense Artillery School
USAAVNSCH	U.S. Army Aviation School
USACOM	U.S. Atlantic Command
USAIC	U.S. Army Information Command
USARER	United States Army Europe
USCENTCOM	U.S. Central Command
USEUCOM	U.S. European Command
USFJ	U.S. Forces Japan
USFK	U.S. Forces Korea
USMC	U.S. Marine Corps
USPACOM	U.S. Pacific Command
USSPACECOM	U.S. Space Command
VHF	Very High Frequency
WES	Waterways Experimentation Station
WPC	Warrior Preparation Center